DOE/GO-102001-1165
NREL/BK-710-29267
May 2001

7.1 Material Selection

According to the Worldwatch Institute, building construction consumes about 40% of the raw materials used worldwide. Roughly three billion tons (2.7×10^{12} kg) of stone, sand, minerals, wood, petroleum, and other materials are extracted and processed into construction materials with a range of environmental consequences. These impacts include land disturbances and habitat loss for mining and logging, solid waste from by-products, and energy use for all stages of the process. Materials can also have a significant impact on the healthiness of the indoor environment. Greening requires a consideration of all these effects alongside the traditional factors of cost, performance, and esthetics. Fortunately, environmentally preferable options, as well as tools and information resources for identifying those options, are becoming more widely available all the time.

Opportunities

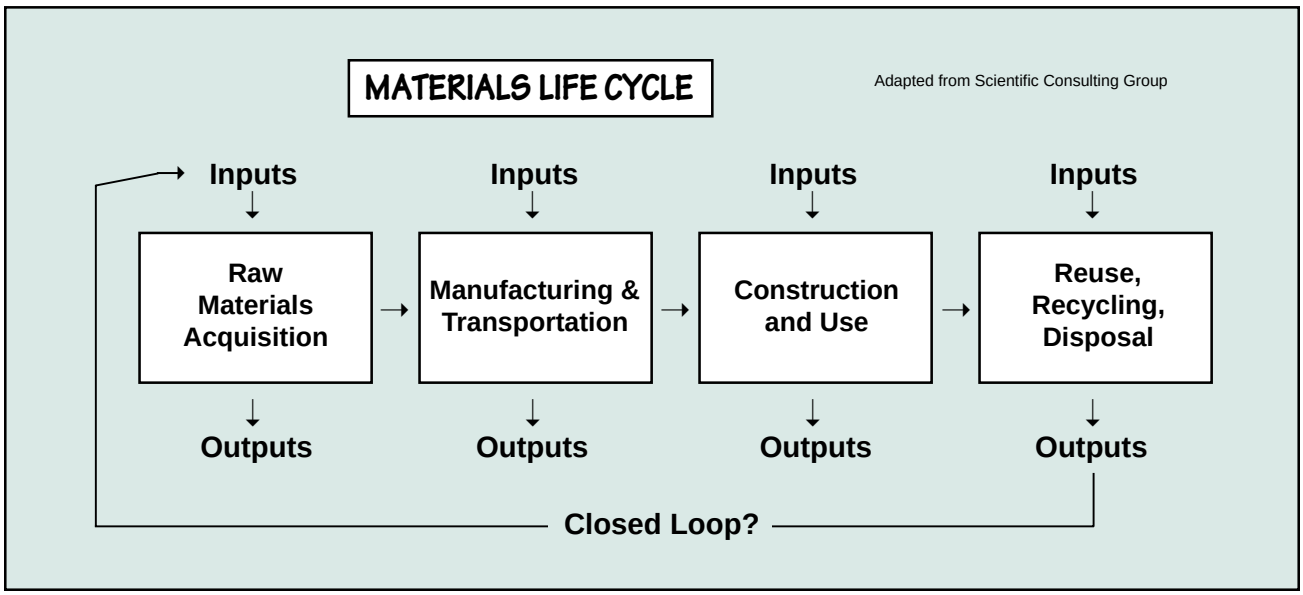
Any renovation or addition presents an opportunity to make environmentally sound material selections. Initial assessments as to the sustainability of likely materials should begin very early in the design process, to help target key areas for improvement. The selection of healthy materials that release low levels of volatile organic compounds is especially important—and easiest to justify economically—during renovations or remodeling in an occupied building. Occupancy of the facility should also be considered: using healthy materials may be a higher priority in a day-care facility or residence than in a well-ventilated industrial facility, for example.

Technical Information

Because materials may have environmental impacts associated with any stage of their production, use, and disposal, a holistic assessment of their entire life cycle is important when selecting them. There is an evolving field of study called "life-cycle assessment" (LCA) (not to be confused with life-cycle costing) that takes this approach. This assessment is based on a life-cycle inventory, which quantifies all significant inputs and outputs at each stage in a material's cycle. Inputs include raw materials, energy, and water used in the process. Outputs include the useful product itself, along with solid waste from by-products, releases to water, and air emissions.

Performing a full LCA is very complex and time-consuming, but resources that streamline the process and provide guidance are increasingly available. These include written reports summarizing the LCA of various materials, articles that describe specific products from an LCA perspective, and even software tools that display life-cycle inventory information from internal databases.

While information sources are improving, so are the materials themselves. New products that offer dramatic environmental advantages are introduced frequently. Many conventional products are exhibiting improvements as well—industry-wide these are incremental, but over time they become significant. For example, older "wet-process" cement kilns are being phased out in favor of new "dry-process" kilns with precalciner chambers. The new facilities use only half as



SAVING MONEY WITH GREENER PAVING

In June 1997, D-M&S, Inc., was awarded a five-year, $1 million-per-year DOD contract to maintain and repair parking lots and access roads at the Pentagon and three other facilities. The contract included an incentive, in the form of a 2% allowable price differential, for the use of optional products with specified environmental attributes. The contractor was able to identify many products meeting and exceeding the environmental goals, including some with superior performance characteristics that it is now using as a matter of course. Additionally, the total cost of the contract, including the incentive payments, is significantly lower than that of comparable parking lot repair projects.

Materials used as of August 1998 include:

- 3,328 tons (3,019 tonnes) of recycled asphalt;
- 1,031 tons (935 tonnes) of recycled concrete;
- 300 cubic yards (229 m^3) of concrete containing recovered materials;
- 3,558 linear feet of low-VOC* paint (<50 g/l);
- 24,324 ft^2 (2,259 m^2) of low-VOC concrete curing compound.

*volatile organic compounds

Source: EPA742-R-96/007

much energy to produce cement. Even more dramatic, however, is the increasing use of industrial waste products, such as coal fly ash, to replace some of the cement in concrete.

References

GreenSpec: The Environmental Building News Product Directory and Guideline Specifications, BuildingGreen, Inc., Brattleboro, VT; (800) 861-0954; www.greenspec.com.

Spiegel, Ross, and Dru Meadows, *Green Building Materials: A Guide to Product Selection and Specification,* John Wiley & Sons, New York, NY, 1999.

EBN Archives CD-ROM (contains detailed articles assessing many materials), BuildingGreen, Inc., Brattleboro, VT; (800) 861-0954; www.BuildingGreen.com.

Building Environmental and Economic Sustainability (BEES) 2.0, National Institute of Standards and Technology; www.nist.gov.